Technical Memorandum

To: Kerry Ritland, Surface Water Manager, City of Issaquah
Peter Rosen, Environmental Planner, City of Issaquah

From: Dave Segal, PE, PMP

Date: December 17, 2015

Subject: Anti-Aircraft Creek Culvert Replacement Wetland Sediment Deposition

Introduction and Background

The replacement culvert and realigned creek bed for Anti-Aircraft Creek at Newport Way NW were designed to mitigate flooding and maintenance problems. An important design element of the project was to mitigate the sediment deposition that historically occurred upstream of the existing culvert. That sediment deposition was caused by the configuration of the culverts, which created a trap for almost the entire sediment load in the creek—and the resulting maintenance work to remove the sediment to prevent flooding of Newport Way. In order to mitigate the sedimentation problem, the new system was designed to carry the sediment load of the creek flow under Newport Way and onto the downstream channel.

Anti-Aircraft Creek, a Class 3 non-fish bearing stream, discharges into a Category II wetland, referred to as Wetland A (Schulz, ESA)[1, 2]. After crossing Newport Way, the Anti-Aircraft Creek channel disappears into a stand of canary grass at the boundary of the wetland. The channel then reforms roughly 30 feet downstream where it continues to Tibbetts Creek. It is assumed that within the wetland, the flow splits between subterranean and sheet flow as it travels downstream through the wetland.

After project construction the total sediment load of the creek will continue past Newport Way through the new culvert and then into the wetland area. The mechanics of this process, along with how the wetland could be impacted by the sediment deposition, were not evaluated in the design report for the culvert replacement because it was assumed that this is a natural consequence of freeing up the culvert along with its natural movement of sediment down Cougar Mountain. However, following a discussion with the

[1] Gary Schulz, Letter to Mr. Derek Doke, Barclay's Realty & Management Co., "Wetland and Stream Determination for Issaquah Farms Property, (Parcel #042308-9029): City of Issaquah," 14 Oct. 2014.

[2] ESA, Letter to Mr. Peter Rosen, City of Issaquah, "Wetland and Stream Review for Issaquah Farms Property," 26 Jan. 2015.

Rivers and Streams Board on this subject, this memo provides additional information on the expected impact of the sediment on the wetland.

Approach

The design report for the culvert and creek realignment includes an analysis of the transport of suspected bed load from the upstream channel. The focus of that analysis was to determine the minimum velocity needed to move the expected bed load gravel through the system. Insofar as the deposition into the wetland is concerned, it was determined that a physical analytical method with quantifiable results of impacts would not be appropriate (nor possible). Instead, below is described the natural processes that are expected to occur within the wetlands in future years following project completion.

Analysis

Sediment deposition into the wetland is characterized as a fluvial deposition process. This process is described in great detail in many publications, including the two sources referenced on page 4 of this memo. In short, a process of sediment deposition followed by subsequent erosion of a new permanent channel will occur within the wetland area that the creek flows through. The creek is intermittent, with periods of dryness and others with short-duration high flows. The nature of the flows within the creek will cause this cycle of deposition and erosion. This process will eventually create a channel.

The contributing basin is a mostly undeveloped, forested hillside with large areas of open space. What this means is that the sediment load within the flow will consist of mostly material from the upstream creek channel itself, and not from the contributing drainage basin as a whole (due to lack of sediment sources in the forested areas). Active channel erosion has been observed upstream and is a major source of the eroded sediment (this entire area is an alluvial fan at the base of Cougar Mountain, containing a large source of erodible materials). Since the total sediment load in the creek is dominated by relatively coarse bed load gravels, the deposition and erosion process within the deposition area in the wetland should create a channel of a meandering shape in that coarse material. This will occur in response to large flood events, when most sediment is transported in the system.

Sediment deposition and subsequent formation of a stream channel through the wetland is not considered an impact, as this is considered a natural process. Natural functions that are present in the wetland will be replaced by natural functions present in the stream. The only reason this has not occurred is because of the unnatural sediment trap that was created 30 years ago as part of the residential development along Oakcrest Drive. If allowed to be transported downstream, these coarse sediments would be beneficial to Tibbetts Creek, to supplement spawning gravels that are in short supply in that system. Because of these factors, it is not expected that the sediment load will deposit sediment into the wetland in a way that will negatively impact the wetland functions, except along the relatively narrow corridor where the new channel will be formed. That channel, along with unimpeded transport of sediment downstream, would be considered beneficial to natural stream systems.

It is noted that sediment deposition into a wetland can be harmful when the nature of the load is fine sediments and the wetland is formed in a depression. Since this sediment load will not contain large amounts of fine sediment, and this particular wetland is sloped from one end to the other, the sediment that is deposited will be transported through it once a permanent channel is formed, minimizing the impact to the wetland.

Conclusion

When the basin, creek, and wetland system are reviewed as a whole using the available data, it is evident that the expected sediment deposition into the wetland will not cause a negative impact. It is expected that over time a channel will form through the wetland and the entire system will reach a balance. Since the sediment load will be comprised mostly of coarser sediments, this will favor the creation of a permanent stream channel through the wetland area, as would have occurred naturally.

References

Wilcock, P., Pitlick, J., and Cui, Y. Sediment transport primer: Estimating bed-material transport in gravel-bed rivers. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station; 2009. 84 p. General Technical Report RMRS-GRR-226. Available from: http://www.fs.fed.us/rm/pubs/rmrs_gtr226.pdf

Yang, Chih Ted. *Sediment Transport: Theory and Practice*. New York: McGraw Hill, 1996.